AMENDMENTS TO THE CLAIMS

This listing of the claims will replace all prior versions, and listings, of claims in the application:

Listing of the claims:

Please amend claims 1, 11, 13, 17 and 18, as follows:

1. (currently amended) A method of forming a copper wiring in a semiconductor device, comprising:

providing a substrate in which a damascene pattern is formed in an interlayer insulating film;

forming a copper anti-diffusion conductive film and a copper layer on the structure including the damascene pattern;

forming a copper wiring in the damascene pattern by means of a chemical mechanical polishing process, wherein the chemical mechanical polishing is performed until a top surface of the copper wiring is concave from a top view and the top surface of the copper wiring has a lowermost portion disposed below a top surface of the interlayer insulating film

performing an annealing process to convert the concave top surface of the copper wiring to a convex top surface so that side edges of the copper wiring that engage the copper anti-diffusion conductive film are disposed below a top surface of the interlayer insulating film; and

forming a copper anti-diffusion insulating film on the entire structure including the convex top surface of the copper wiring.

2. (canceled)

3. (previously presented) The method as claimed in claim 1, further comprising a cleaning process after the performing of the chemical mechanical polishing process.

4. (original) The method as claimed in claim 3, wherein the cleaning process is performed using a cleaning agent containing nitric acid so that the surface of the copper wiring is further lower than the surface of the interlayer insulating film.

5. (currently amended) The method as claimed in claim 1, wherein the annealing process is performed in an inert gas atmosphere such as N_2, Ar, H_2, ~~or~~ He or a mixture thereof at a temperature in the range of 100°C to 500°C.

6. (previously presented) The method as claimed in claim 1, wherein the annealing process is performed in an inert gas atmosphere of N_2, Ar, H_2 or He or a mixture thereof, or in a vacuum, and at a temperature in the range of 200°C to 700°C for 1 to 5 minutes.

7. (previously presented) The method as claimed in claim 1, wherein a plasma processing is further performed between the forming of the copper wiring and the forming of the copper anti-diffusion insulating film.

8. (previously presented) The method as claimed in claim 7, wherein the plasma processing is carried out in an atmosphere selected from the group consisting of a mixture of nitrogen and hydrogen, ammonia, and a mixture of hydrogen and inert gas not containing nitrogen and at a temperature in the range of 100°C to 350°C.

9. (original) The method as claimed in claim 1, wherein the copper anti-diffusion insulating film is formed by covering a material having a copper anti-diffusion property and a good fluidity property by means of a spin-on-deposition method, and then performing an annealing process for the material.

10. (original) The method as claimed in claim 9, wherein the copper anti-diffusion insulating film is formed using materials such as methyl, benzochlorobutane, polyimide, arylether and hydrogen silsesquioxane, which contain Si, C and N in a type of a sol or gel.

11. (currently amended) A method as claimed in claim 9, wherein the annealing process is performed in an atmosphere of an inert gas such as N_2, Ar, H_2, ~~or~~ He or a ~~a~~ mixture thereof at a temperature in the range of 100°C to 500°C.

12. (original) The method as claimed in claim 9, wherein the annealing process is performed in a vacuum state at a temperature in the range of 100°C to 500°C.

13. (currently amended) A method of forming a copper wiring in a semiconductor device, comprising:

providing a substrate in which a damascene pattern is formed in an interlayer insulating film;

forming a copper anti-diffusion conductive film and a copper layer on the structure including the damascene pattern;

forming a copper wiring by means of a chemical mechanical polishing process, wherein the chemical mechanical polishing is performed until a top surface of the copper wiring is concave from a top view and the top surface of the copper wiring has a lowermost portion disposed below a top surface of the interlayer insulating film;

performing an annealing process to convert the concave top surface of the copper wiring to a convex top surface so that side edges of the copper wiring that engage the copper anti-diffusion conductive film are disposed below a top surface of the interlayer insulating film; and

forming a selective copper anti-diffusion conductive film on the convex top surface of the copper wiring.

14. (canceled)

15. (previously presented) The method as claimed in claim 13, further comprising performing a cleaning process after the performing or the chemical mechanical polishing process.

16. (original) The method as claimed in claim 15, wherein the cleaning process is performed using a cleaning agent containing nitric acid so that the surface of the copper wiring is further lower than the surface of the interlayer insulating film.

17. (currently amended) The method as claimed in claim 13, wherein the annealing process is performed ~~using~~ in an inert gas atmosphere such as N_2, Ar, H_2 or He or a mixture thereof and at a temperature in the range of 100°C to 500°C.

18. (currently amended) The method as claimed in claim ~~14~~ 13, wherein the annealing process is performed ~~using~~ in inert gas atmosphere of N_2, Ar, H_2 or He or a mixture thereof or in a vacuum state and at a temperature in the range of 200°C to 700°C for 1 to 5 minutes.

19. (previously presented) The method as claimed in claim 14, wherein a plasma processing is further performed between the forming of the copper wiring and the forming of the copper anti-diffusion conductive film.

20. (previously presented) The method as claimed in claim 19, wherein the plasma processing is carried out in an atmosphere of a mixture of nitrogen and hydrogen, ammonia, or a mixture of hydrogen and inert gas not containing nitrogen and at a temperature in the range of 100°C to 350°C.

21. (original) The method as claimed in claim 13, wherein the selective copper anti-diffusion conductive film is formed within the damascene pattern without causing a step with the interlayer insulating film.

22. (previously presented) The method as claimed in claim 21, the selective copper anti-diffusion conductive film is formed using a material having a high melting point by means of a selective electroless plating method.

23. (original) The method as claimed in claim 21, the selective copper anti-diffusion conductive film is formed by means of a selective chemical vapor deposition (CVD) method.

24. (previously presented) The method as claimed in claim 13, the selective copper anti-diffusion conductive film is formed using a material having a high melting point by means of a selective electroless plating method.

25. (original) The method as claimed in claim 13, the selective copper anti-diffusion conductive film is formed by means of a selective chemical vapor deposition (CVD) method.